Introductory Comments

The Office Action

The drawings were objected to under 37 CFR 1.83(a) because they fail to show frame memory 42 as described in the specification.

Claims 1-2 and 9 were rejected under 35 U.S.C. 102(e) as being clearly anticipated by Hay et al (4,238,828).

Claims 3-8 and 14-16 were rejected under 35 U.S.C. 103(a) as being unpatentable over Hay et al (4,238,828) in view of Naimark et al (4,857,902).

Claims 10-13 were allowed, which is gratefully acknowledged.

The Present Application

For purposes of brief review, the present application describes a method and apparatus for identifying a position of a predetermined object in free space using a video image. The invention involves an object which includes an alignment indicator representing a pointing direction and at least three equidistantly spaced co-linear points, all of which are limited in their placement to a position on the object. This object is observed by a video camera. Known camera geometric dimensions provide a basis for converting the projected two-dimensional image of the object into a three-dimensional coordinate definition of the object in a free space.

The References of Record

Hay et al discloses a position detecting apparatus which detects the position of a target which comprises radiation emitting means for emitting radiation to define four points in a non-planar relationship such that a first set of three points lies in a first target plane while a second set of three points lies in a second target plane. A camera is arranged for viewing the target, and being provided at the focal plane with a two-dimensional array of photo sensitive elements which can receive radiation from the radiation emitting means of the target. A computer scans the array to generate signals indicative of the position of the images of the radiation emitting means on the array, whereby the position of the target and of the object to which it is attached is determined. The scanning system requires multiple targets (i.e., cross target 9, ring target 10, and five lines of LEDs 20 to 24) for positive identification.

Naimark et al discloses a position-dependent interactivity system for image display which involves an interactive video display system which allows the user to access a library of frames of video data stored in randomly accessible data locations. The video data is assigned a virtual position in a pre-defined data space, such that the visual image in each frame is related to visual images in other frames by virtual position in the data space. A user provides input to the display system generating displacement signals. The input signal is translated to an updated virtual position in the data space relative to a previous virtual position and the next frame having the updated virtual position is displayed next.

Remarks

The drawings were amended to comply with 37 CFR 1.83(a) as per the examiner's recommendation. The frame memory depicted in figure 4 has been labeled number 42 as defined in the specification.

The specification has been amended to correct minor mistakes. The amendments to the specification do not represent any new matter.

With respect to **claim 1**, the applicant respectfully submits that the subject matter claims differs from the art taught in Hay et al in that Hay teaches the detection of the orientation of an object with known distance and direction from multiple targets which are identified in multiple view planes of a video camera. In the present invention, the orientation in free space of a preselected locating device is claimed with mere access to predetermined indicia disposed on the locating device. The locating device is an object used to recognize and identify a particular point in free space by a user. Hay teaches an apparatus whereby the location of lines on a target are detected in order to calculate the location of a fixed object connected to the said target.

Claim 1 differs from the system disclosed in Hay in that Hay calculates the coordinate position of points on a target plane, rather than on the object itself. The present invention discloses a method whereby the relative positions of points on the locating device itself are recognized, and the coordinate positions of those points are calculated based only on the points' relative positions and known camera geometric dimensions.

The present invention is advantageous over Hay in that it does not require a target at a known distance from the object whose orientation is being identified. This creates a free range of motion for the object which is optimal for user interactivity with the free space where the object is oriented. The absence of a target, present in the invention described in Hay, allows the locating device to be freely moved throughout the space.

It is therefore respectfully submitted that claim 1 and claims 2-9 dependent on claim 1, distinguish patentably and unobviously over Hay.

In addition to **claim 2** being distinguished because of its relationship to claim 1, claim 2 is distinguished from the invention in Hay in that Hay describes a process whereby 4 points on a target are used to identify the target's position. 3 of the points are in a co-planar triangular arrangement (see Hay et. al, figures 2 and 4, indicated by the points A, B, C and D), and the four points together are in a non co-planar relationship (see Hay et al, col. 6 line 10). In the present invention, the three points are co-linear, creating an optimal arrangement for a locating device.

Regarding **claim 14**, the claim has been amended to reflect a locating device including a plurality of equidistantly-spaced, co-linear indicia. Hay does not disclose a system for identifying a position and pointing direction of a preselected locating device in a three dimensional free space by mere recognition of indicia on the locating device alone. This is an advantage over Hay in that a locating device can be moved freely in space unlike the fixed head of a tunneling machine whose position is identified in Hay.

Additionally, the applicant respectfully submits that there was no motivation at the time of invention to combine the references of Hay and Naimark. Hay discloses a position detecting apparatus primarily aimed at detecting the position of an object, in particular, the head of a tunneling machine by use of a video camera. Naimark discloses a position-dependent interactivity system for image display, which allows a user to interact with video data. The virtual position of video data is determined, so that when a user uses a trackball or other device to select certain video data, the virtual position would change and alternate video would be displayed. The applicant respectfully submits that it would not be obvious to combine a position detecting apparatus which detects the location of an object with a reference defining a system for video image interactivity and display.

It is therefore respectfully submitted that claim 14 and claims 15-16 dependent on claim 14 distinguish patentably and unobviously over Hay and Naimark.

Conclusion

In view of the foregoing, it is submitted all claims are now in condition for allowance. An early notice to that effect is therefore earnestly solicited.

Respectfully submitted,

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